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ABSTRACT

Six nonverbal, autistic boys (ages 6 to 11) were studied to assess what was learned when signs and spoken words were presented simultaneously. The boys were taught to discriminate among several available objects when given commands consisting of simultaneously signed and spoken object labels. Each of the six children mastered all of the discriminations that were taught. Results showed that the children varied in the extent to which they attended to the spoken words used during training. For two of the six children correct discriminative responding had been controlled solely by the signs, while spoken words had remained nonfunctional. A pretraining test of verbal imitation ability was accurate in predicting the extent to which each child would attend to both modalities. Extensive figures and charts supplement the text. (Author/PHR)

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SIGN LANGUAGE COMPREHENSION BY AUTISTIC CHILDREN FOLLOWING SIMULTANEOUS COMMUNICATION TRAINING

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The present study was designed to systematically assess what is learned when signs and spoken words are presented simultaneously in teaching autistic children to comprehend sign language. Six non-verbal, autistic boys were taught to discriminate among several available objects when given commands consisting of simultaneously signed and spoken object labels. Each of the six children mastered all of the discriminations that were taught. Post-training assessment probes revealed that all six children successfully attended to the signs presented during training. However, the children varied in the extent to which they attended to the spoken words used during training. For two of the six children, correct discriminative responding had been controlled solely by the signs, while the spoken words had remained non-functional. A pre-training test of verbal imitation ability was accurate in predicting the extent to which each child would attend to both modalities used during simultaneous communication training. The results of this study suggest that sign language is a viable communication system for autistic children. They can be taught to understand signs, but for some children, the addition of spoken words along with the signs provides no additional cues for learning.

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ALMOST ALL REPORTED STUDIES OF SIGN LANGUAGE TRAINING WITH AUTISTIC CHILDREN HAVE USED A TEACHING METHOD CALLED SIMULTANEOUS COMMUNICATION, IN WHICH SIGNS AND SPOKEN WORDS ARE PRESENTED TOGETHER DURING TRAINING. RESEARCH ON THE PERCEPTUAL ANOMALIES OF AUTISTIC CHILDREN, ESPECIALLY EVIDENCE OF OVERSELECTIVITY IN THE PRESENCE OF MULTIPLE STIMULI, SUGGESTS THAT A MULTISENSORY TEACHING APPROACH, LIKE SIMULTANEOUS COMMUNICATION, MAY NOT BE APPROPRIATE FOR ALL AUTISTIC CHILDREN LEARNING SIGN LANGUAGE. THE PRESENT STUDY WAS DESIGNED TO SYSTEMATICALLY ASSESS WHAT IS LEARNED WHEN SIGNS AND SPOKEN WORDS ARE PRESENTED SIMULTANEOUSLY IN TEACHING AUTISTIC CHILDREN TO COMPREHEND SIGN LANGUAGE.

METHODS AND RESULTS

SIX NON-VERBAL, AUTISTIC MALES, AGES 6 - 11, WERE TAUGHT TO DISCRIMINATE AMONG SEVERAL AVAILABLE OBJECTS WHEN GIVEN COMMANDS CONSISTING OF SIMULTANEOUSLY SIGNED AND SPOKEN OBJECT LABELS. FOR EXAMPLE, THE SIGNS FOR 'TOUCH COMB' WOULD BE ACCOMPANIED BY THE SPOKEN WORDS 'TOUCH COMB' IN THE PRESENCE OF A FOUR OBJECT ARRAY, E.G., COMB, PENCIL, SOAP AND CUP. SIX SUCCESSIVE SETS, EACH CONTAINING FOUR OBJECTS, WERE TAUGHT TO EACH CHILD. FOR THREE OF THE SIX CHILDREN, TRAINING WAS CONDUCTED USING A MULTIPLE BASELINE EXPERIMENTAL DESIGN.

EACH OF THE SIX CHILDREN MASTERED ALL OF THE DISCRIMINATIONS THAT WERE TAUGHT. FOLLOWING MASTERY OF EACH SET, STIMULUS CONTROL ASSESSMENTS WERE CONDUCTED TESTING EACH CHILD'S RESPONSE TO THE JUST-TRAINED OBJECTS, USING SIGNED-ONLY (VISUAL PROBES) AND SPOKEN-ONLY (AUDITORY PROBES) COMMANDS. THESE POST-TRAINING ASSESSMENT PROBES REVEALED THAT 1) ALL SIX CHILDREN ATTENDED TO THE SIGNS PRESENTED DURING TRAINING AND 2) FOR TWO OF THE SIX CHILDREN, CORRECT RESPONDING DURING TRAINING HAD BEEN CONTROLLED SOLELY BY THE SIGNS, WHILE THE SPOKEN WORDS REMAINED NON-FUNCTIONAL.

A PRE-TEST OF VERBAL IMITATION ABILITY, GIVEN PRIOR TO ANY TRAINING, WAS ACCURATE IN PREDICTING THE EXTENT TO WHICH EACH CHILD WOULD ATTEND TO BOTH MODALITIES USED DURING SIMULTANEOUS COMMUNICATION TRAINING. EACH CHILD'S PERCENTAGE OF CORRECT VERBAL IMITATION CORRELATED POSITIVELY WITH HIS ATTENTION TO THE

SPOKEN WORDS USED DURING TRAINING, AS MEASURED BY HIS AVERAGE PERCENTAGE OF CORRECT RESPONDING TO SPOKEN-ONLY COMMANDS DURING POST-TRAINING AUDITORY PROBE SESSIONS ($r = .92, p < .05$). THE TWO CHILDREN WHO RELIED PRIMARILY ON THE SIGNS DURING TRAINING RESPONDED CORRECTLY TO ONLY 21.7% AND 24.6% OF THE AUDITORY PROBE TRIALS. EACH HAD IMITATED ON ONLY 24% OF THE VERBAL IMITATION TEST TRIALS. TWO CHILDREN, WHOSE AVERAGE CORRECT RESPONDING DURING AUDITORY PROBES WAS 60% AND 77.5%, HAD IMITATED CORRECTLY ON 52% AND 60% OF THE VERBAL IMITATION TEST TRIALS, RESPECTIVELY. THE LAST TWO CHILDREN, WHO CAME TO ATTEND EQUALLY WELL TO BOTH SIGNS AND SPOKEN WORDS DURING TRAINING, HAD IMITATED ON 72% AND 100% OF THE VERBAL IMITATION TEST TRIALS.

NOTE: ONLY PARTIAL POST-TRAINING PROBE DATA IS REPORTED FOR TWO OF THE CHILDREN WHO BECAME UNAVAILABLE PRIOR TO THE COMPLETION OF THE STUDY.

CONCLUSIONS

THE RESULTS OF THIS STUDY SUGGEST THAT SIGN LANGUAGE IS A VIABLE COMMUNICATION SYSTEM FOR AUTISTIC CHILDREN. THESE CHILDREN CAN BE TAUGHT TO UNDERSTAND SIGNS WHICH ARE PRESENTED TO THEM. HOWEVER, NOT ALL CHILDREN MAY RESPOND TO THE SAME TEACHING METHOD. WE FOUND THAT THESE AUTISTIC CHILDREN VARIED IN THEIR ABILITY TO ATTEND TO, AND THUS BENEFIT FROM, BOTH THE SIGNS AND THE SPOKEN WORDS, WHEN THEY WERE PRESENTED TOGETHER DURING TRAINING. FOR SOME CHILDREN, THE ADDITION OF SPOKEN WORDS ALONG WITH THE SIGNS PROVIDES NO ADDITIONAL LEARNING CUES. IN OTHER WORDS, FOR THESE CHILDREN, ACQUISITION OF THE RECEPTIVE SIGN LANGUAGE DISCRIMINATIONS WAS THE RESULT OF VISUAL DISCRIMINATIONS WHICH WERE LEARNED ON THE BASIS OF THE SIGNS PRESENTED, BUT NOT AUDITORY DISCRIMINATIONS BASED UPON THE SIMULTANEOUSLY PRESENTED SPOKEN LABELS. SIMULTANEOUS COMMUNICATION, FOR THESE AUTISTIC CHILDREN, MAY BE NO MORE BENEFICIAL THAN THE SIMPLE PRESENTATION OF SIGNS ALONE, AND MAY ACTUALLY BE LESS EFFECTIVE. WE WERE ABLE TO PREDICT, ON THE BASIS OF A SIMPLE DIAGNOSTIC TEST OF ABILITY TO IMITATE VERBAL STIMULI, WHICH CHILDREN ARE MOST LIKELY TO BENEFIT FROM THE ADDITIONAL INFORMATION PROVIDED BY SIMULTANEOUS COMMUNICATION. THIS PREDICTIVE ABILITY IS VALUABLE IN THE DEVELOPMENT OF INDIVIDUALIZED LANGUAGE TRAINING CURRICULA WHICH TAKE ADVANTAGE OF EACH CHILD'S ATTENTIONAL STRENGTHS.

TABLE 1

SUBJECT	AGE	M.A.	PRE-TRAINING TEST OF VERBAL IMITATION: % CORRECT	POST-TRAINING AUDITORY PROBES: AVERAGE % CORRECT (AVERAGE FOR 6 SETS)
M.L.	11-2	5-1	24	21.7
J.M.	9-9	5-4	24	24.6
M.G.	6-1	4-4	52	60.6*
T.G.	8-6	4-7	56	77.5*
L.L.	11-5	4-8	72	90.0
A.D.	8-8	4-9	100	90.0

($r = .92, p < .05$)

THIS TABLE CLEARLY SHOWS THE POSITIVE CORRELATION BETWEEN EACH CHILD'S SCORE ON A PRE-TRAINING TEST OF VERBAL IMITATION AND HIS ATTENTION TO THE AUDITORY COMPONENT OF SIMULTANEOUSLY SIGNED AND SPOKEN COMMANDS DURING SUBSEQUENT TRAINING. THIS ATTENTION IS MEASURED BY THE CHILD'S CORRECT RESPONDING DURING THE POST-TRAINING AUDITORY PROBES. THIS RELATIONSHIP IS INDEPENDANT OF THE CHILDREN'S CHRONOLOGICAL OR MENTAL AGE.

*FIGURES BASED ON PARTIAL DATA - 4 SETS FOR M.G. AND 3 SETS FOR T.G.

MULTIPLE BASELINE TRAINING DATA

FIGURES 1 THROUGH 3

TO DEMONSTRATE THE EFFICACY OF OUR SPECIFIC TRAINING PROCEDURES, THREE OF THE SIX CHILDREN WERE TAUGHT THE DISCRIMINATIONS AMONG THE OBJECTS IN THE FIRST THREE SETS UTILIZING A MULTIPLE BASELINE EXPERIMENTAL DESIGN. IN THIS DESIGN, EACH CHILD'S ABILITY TO IDENTIFY THE OBJECTS WITHIN EACH SET WAS TESTED PRIOR TO TRAINING ON SET 1. FOLLOWING TRAINING ON SET 1, THE CHILD'S PERFORMANCE ON EACH OF THE THREE SETS WAS TESTED AGAIN, AND SO ON UNTIL ALL OF THE SETS HAD BEEN TRAINED.

THESE GRAPHS DEMONSTRATE THAT, FOR EACH CHILD, CORRECT RESPONDING TO THE OBJECTS WITHIN A SET REMAINED AT A CHANCE LEVEL UNTIL TRAINING (DESIGNATED BY THE BROKEN LINE) FOR THAT PARTICULAR SET WAS COMPLETED. EXPOSURE TO THE OBJECTS ALONE THROUGH REPEATED BASELINE TESTING DID NOT, IN ANY CASE, RESULT IN THE LEARNING OF THE OBJECT DISCRIMINATION. THUS, WE CONCLUDE THAT OUR SPECIFIC TRAINING PROCEDURES, INCLUDING PROMPTING, FADING OF THOSE PROMPTS, STIMULUS ROTATION, AND DIFFERENTIAL REINFORCEMENT, WERE SUCCESSFUL IN TEACHING EACH OF THE CHILDREN ALL OF THE DISCRIMINATIONS.

FIGURE 1

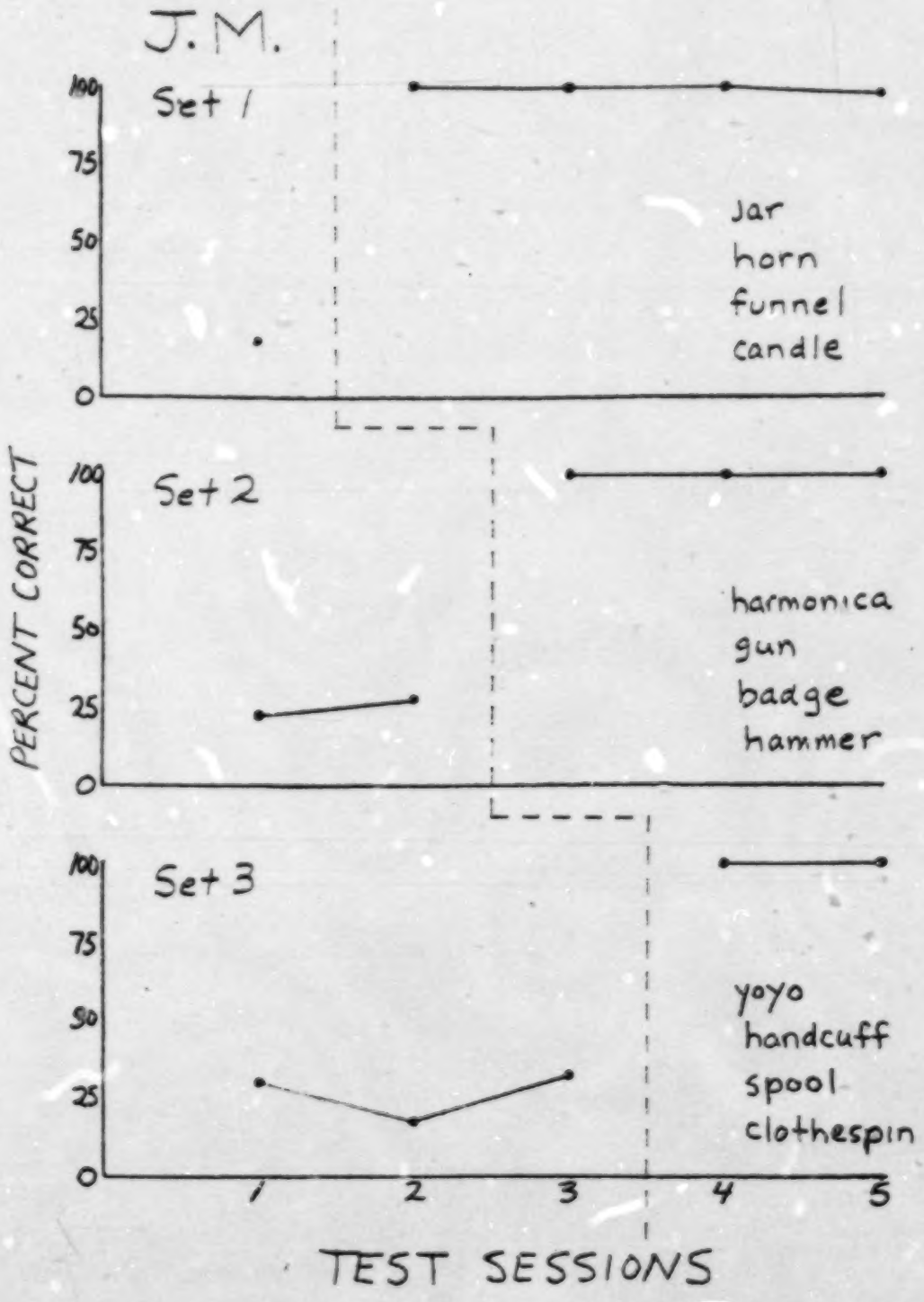

J.M.
Set 1
Set 2
Set 3
100
75
50
25
0
PERCENT CORRECT
Jar
horn
funnel
candle
harmonica
gun
badge
hammer
yoyo
handcuff
spool
clothespin
1
2
3
4
5
TEST SESSIONS

FIGURE 2

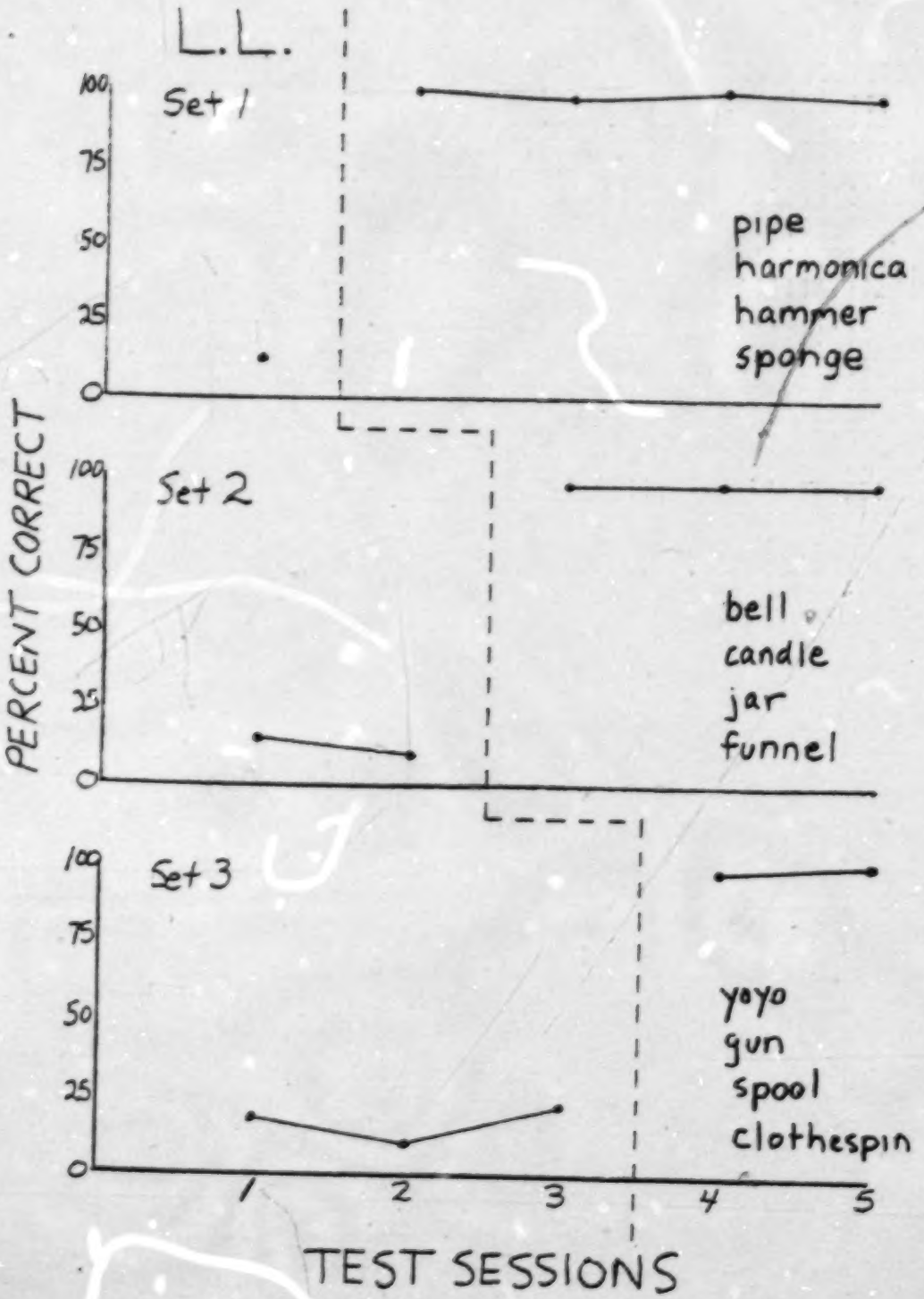
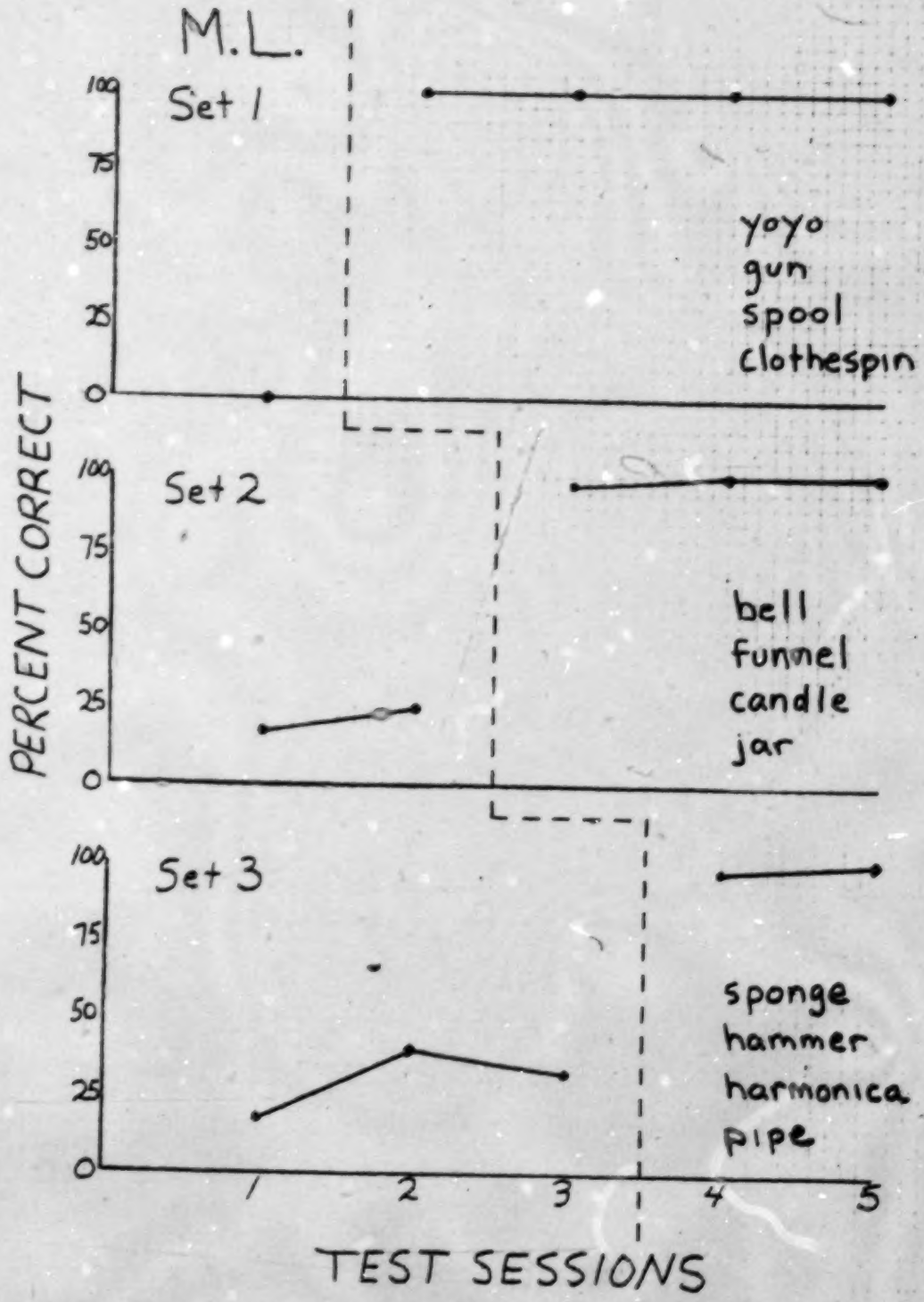

L.L.
Set 1
100
75
50
25
0
pipe
harmonica
hammer
sponge
Set 2
bell
candle
jar
funnel
Set 3
yoyo
gun
spool
clothespin
PERCENT CORRECT
1
2
3
4
5
TEST SESSIONS

FIGURE 3


M.L.
Set 1
Set 2
Set 3
PERCENT CORRECT
100
75
50
25
0
yoyo
gun
spool
clothespin
bell
funnel
candle
jar
sponge
hammer
harmonica
pipe
1
2
3
4
5
TEST SESSIONS

STIMULUS CONTROL ASSESSMENTS - AUDITORY AND VISUAL PROBES

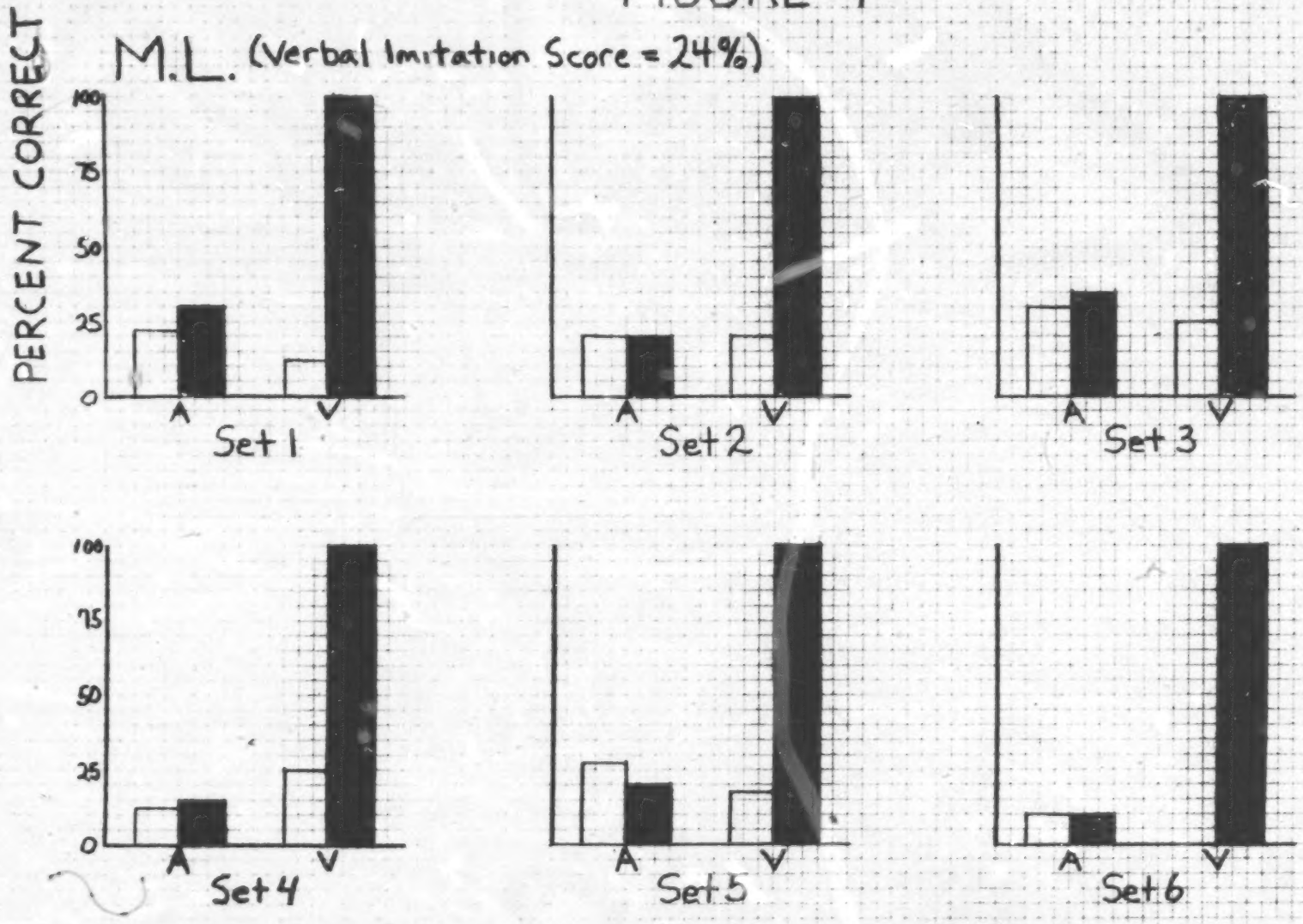
FIGURES 4 THROUGH 9

HAVING DEMONSTRATED THAT OUR TRAINING PROCEDURES DID RESULT, IN EVERY CASE, IN MASTERY OF THE OBJECT DISCRIMINATIONS, WE SOUGHT TO DETERMINE WHICH COMPONENT OF THE SIMULTANEOUSLY SIGNED AND SPOKEN TRAINING COMMANDS HAD COME TO CONTROL EACH CHILD'S CORRECT RESPONDING.

AFTER TEACHING EACH CHILD A SET OF DISCRIMINATIONS USING BOTH SIGNS AND SPOKEN WORDS, WE TESTED THEIR PERFORMANCE ON THE SAME SET OF OBJECTS, USING SIGNED-ONLY AND SPOKEN-ONLY COMMANDS IN VISUAL AND AUDITORY PROBES. EACH CHILD'S PERCENT CORRECT RESPONDING TO THESE STIMULUS CONTROL PROBES IS SHOWN IN THE ADJOINING GRAPHS. THE OPEN BARS REPRESENT PERFORMANCE PRIOR TO TRAINING FOR THE PARTICULAR SET, AND THE DARKENED BARS REPRESENT PROBE PERFORMANCE IMMEDIATELY FOLLOWING TRAINING.

NOTE THAT ALL OF THE CHILDREN RESPONDED QUITE ACCURATELY TO THE SIGNED-ONLY (VISUAL PROBE) COMMANDS, WHILE THE EXTENT TO WHICH EACH CHILD ATTENDED TO THE SPOKEN-ONLY (AUDITORY PROBE) COMMANDS VARIED. ATTENTION TO SPOKEN-ONLY COMMANDS WAS POSITIVELY CORRELATED WITH THE CHILD'S PERFORMANCE ON A VERBAL IMITATION TEST GIVEN PRIOR TO THE BEGINNING OF ANY TRAINING. EACH CHILD'S PERCENTAGE OF CORRECT IMITATION IS LISTED ON HIS GRAPH.

FIGURE 4



A: Auditory Presentation (Words Only) □: Prior to training sign and word
V: Visual Presentation (Signs Only) ■: After training sign and word

FIGURE 5

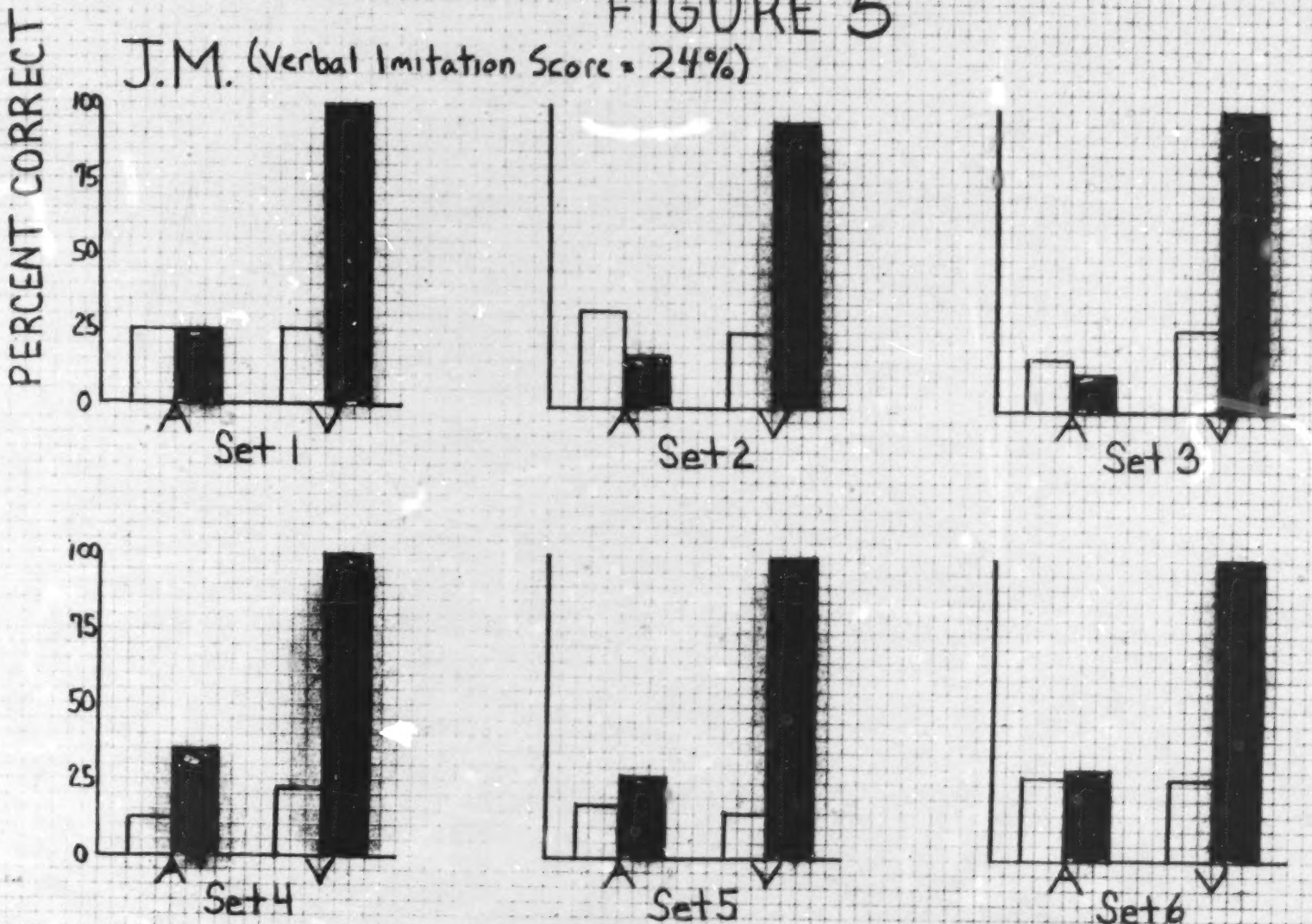
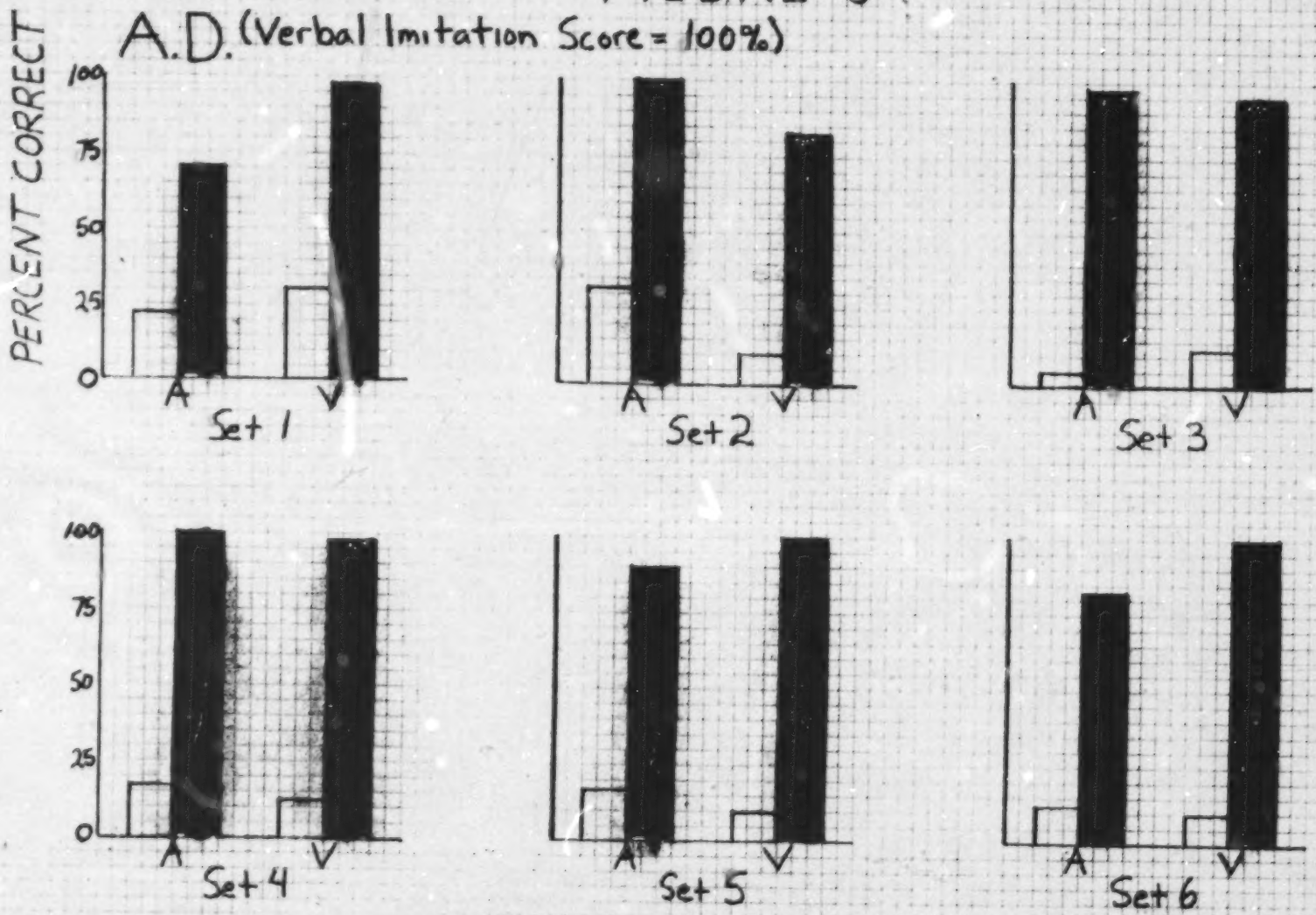
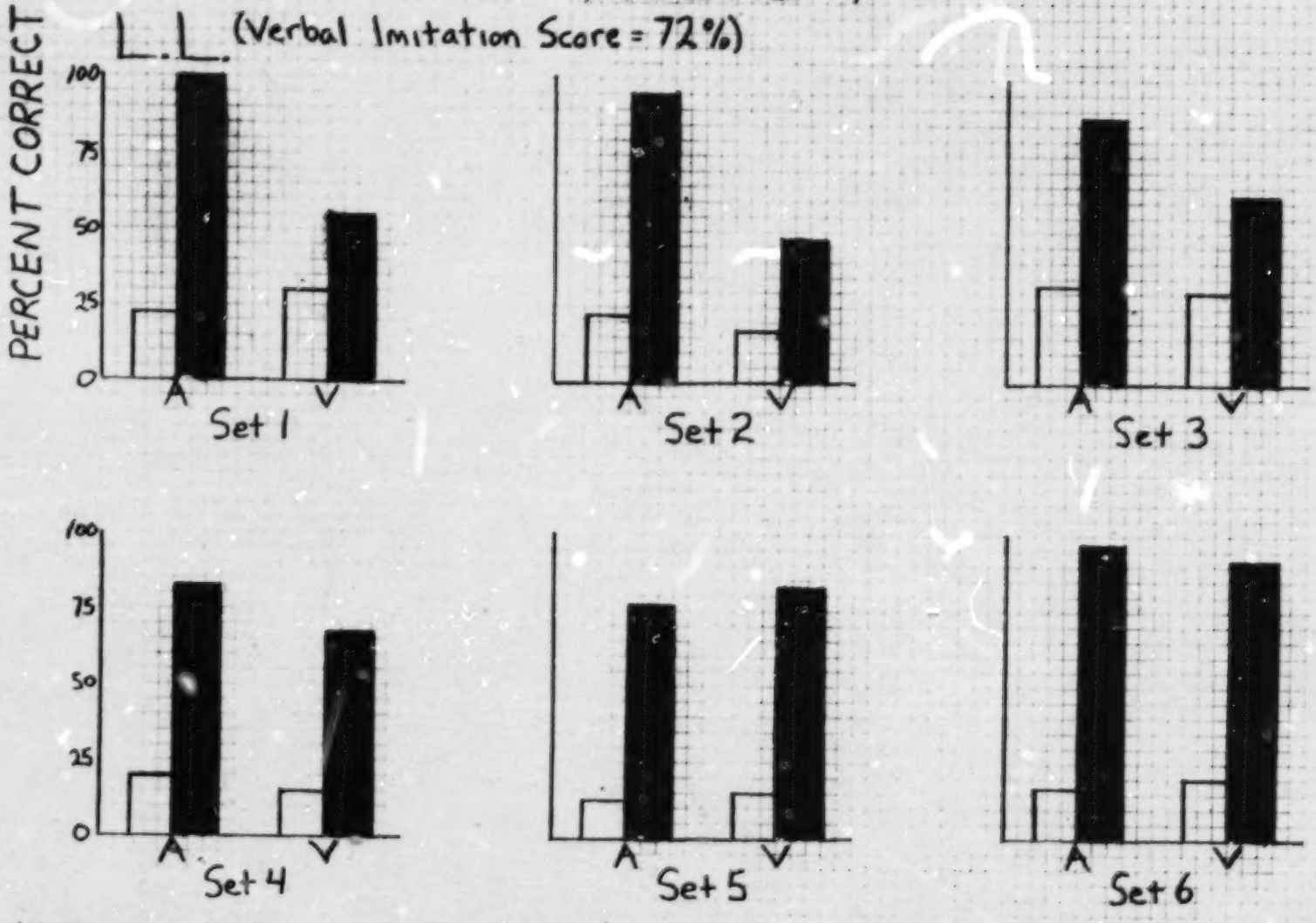

J.M. (Verbal Imitation Score = 24%)
PERCENT CORRECT
100
75
50
25
0
A
V
Set 1
Set 2
Set 3
Set 4
Set 5
Set 6
A: Auditory Presentation (Words Only)
V: Visual Presentation (Signs Only)
□: Prior to training sign and word
■: After training sign and word

FIGURE 6



A: Auditory Presentation (Words Only) □: Prior to training sign and word
V: Visual Presentation (Signs Only) ■: After training sign and word

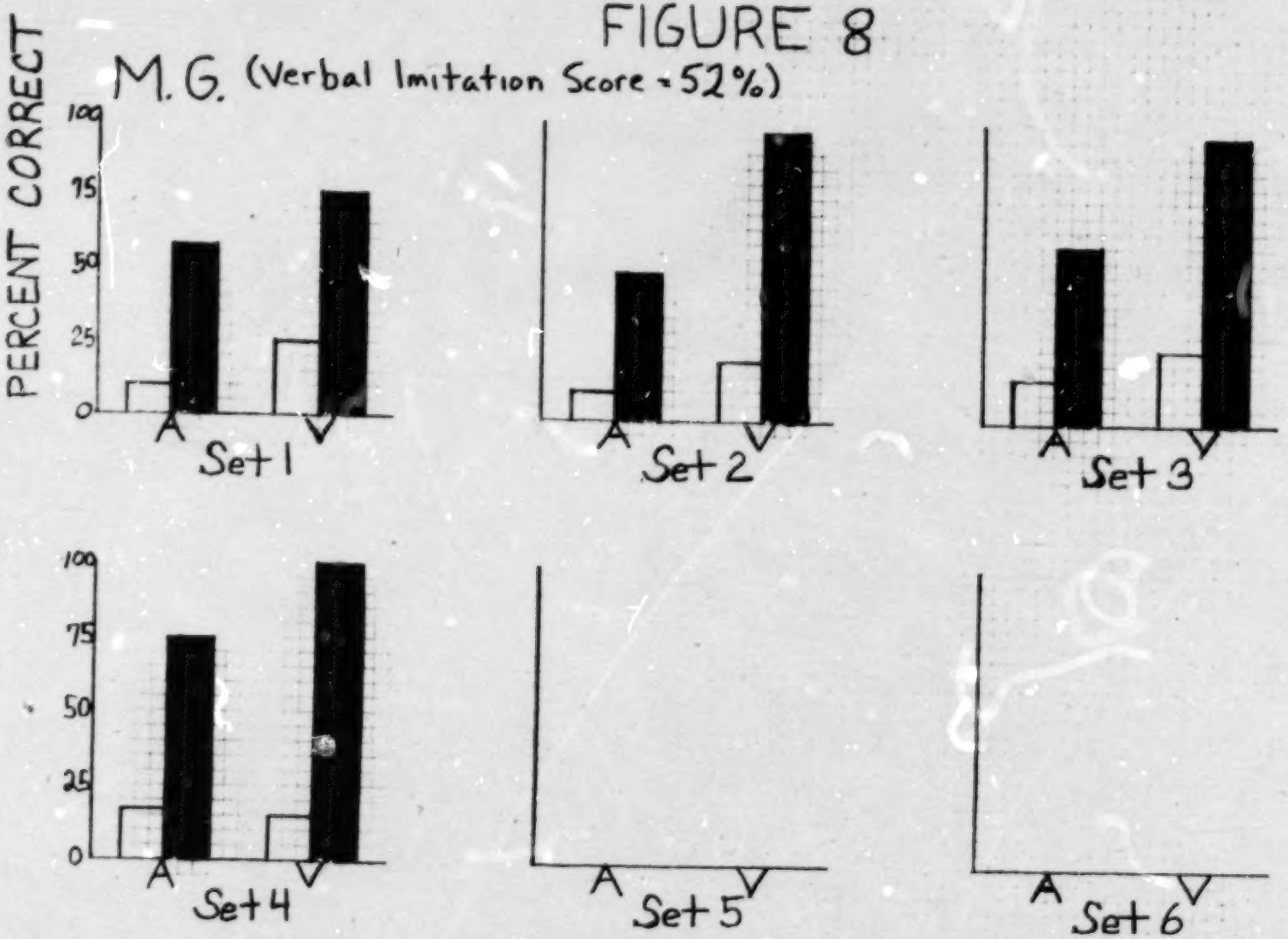
FIGURE 7



A: Auditory Presentation (Words Only)
V: Visual Presentation (Signs Only)

□: Prior to training sign and word
■: After training sign and word

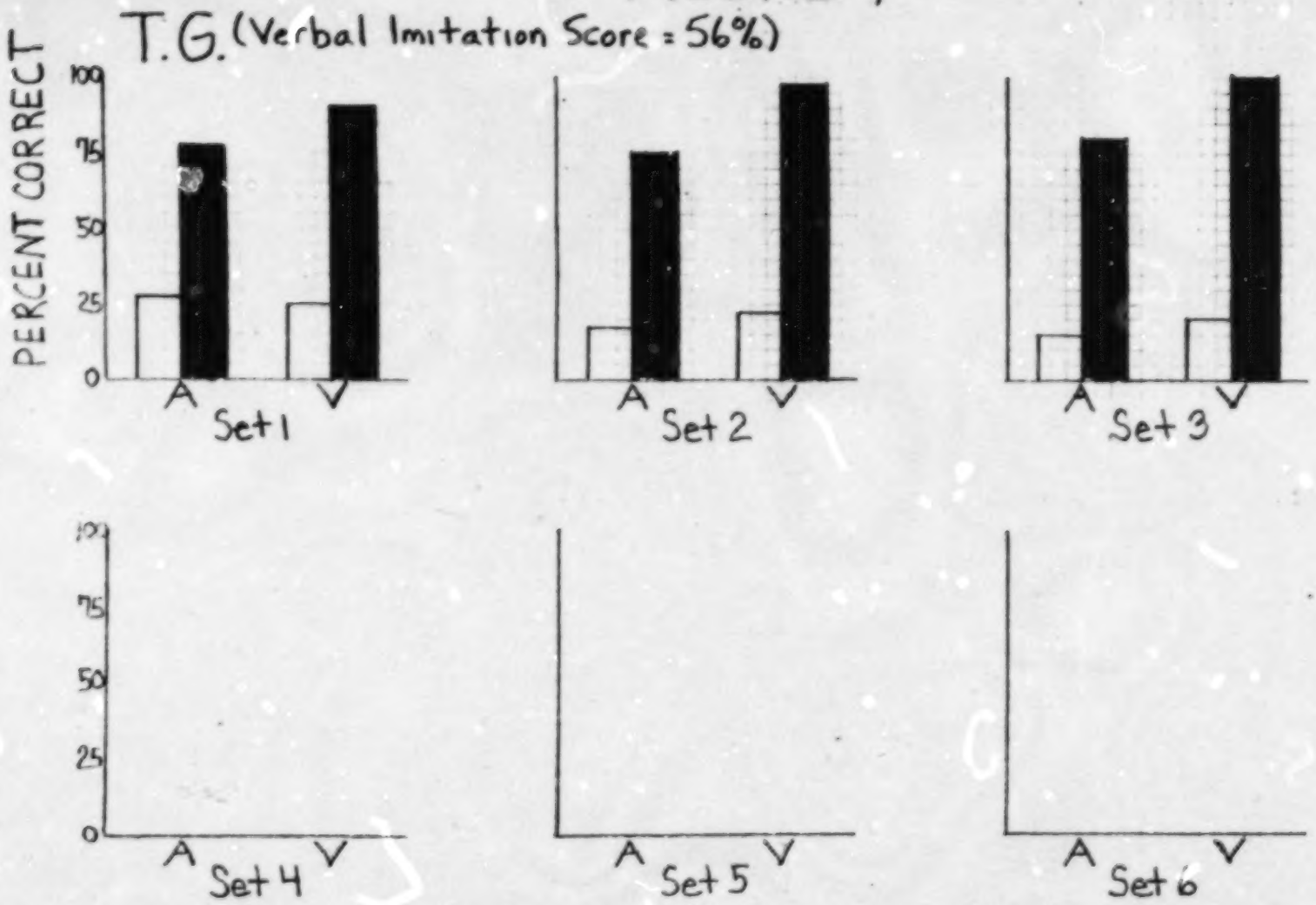
FIGURE 8



A: Auditory Presentation (Words Only)
V: Visual Presentation (Signs Only)

□: Prior to training sign and word
■: After training sign and word

FIGURE 9



A: Auditory Presentation (Words Only) □: Prior to training sign and word
V: Visual Presentation (Signs Only) ■: After training sign and word